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Original Article

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Abstract

This study was designed to compare the therapeutic benefits of a compound of omega-3 fatty acids from the New Zealand green-lipped mussel (*Perna canaliculus*) (PCSO-524) and omega-3 fatty acids in fish oil on clinical outcomes and osteoarthritis biomarkers (chondroitin sulfate WF6 epitope) in 66 dogs that had osteoarthritis (OA); 39 dogs with OA hip joints, 15 dogs with OA shoulder joints and 12 dogs with OA shoulder and hip joints. The animals were presented at the Small Animal Hospital, Faculty of Veterinary Science, Chulalongkorn University. The dogs were allocated into two groups randomly. One group received PCSO-524 (n = 33) and the other group received fish oil (n = 33), administered orally for 24 weeks. Serum OA biomarkers (WF6), lameness scores, weight-bearing scores, range of motion (ROM) and peak vertical force gait analysis were evaluated before treatment and two, four, eight, 12, 16, 20 and 24 weeks after the treatment began. The mean of serum WF6 of the PCSO-524 group (262.46±118.06 ng/ml) was significantly (p<0.05) less than that of the fish oil group (324.76±133.65 ng/ml) after 24 weeks of administration. The lameness scores, weight-bearing scores, peak vertical force gait analysis results and ROM improved significantly within two weeks after the administration of PCSO-524 began, while there was no statistically significant improvement in any of the parameters of the fish oil group after 12 weeks. After week four, the lameness and weight-bearing scores and gait analysis results of the PCSO-524 group improved significantly by comparison with the fish oil group. In conclusion, the PCSO-524 administration led to good clinical outcomes and laboratory results of osteoarthritis of the shoulder and hip joints in dogs.

Keywords: canine, fish oil, green-lipped mussel, osteoarthritis, PCSO-524, WF6

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Introduction

The understanding of the pathogenesis of osteoarthritis (OA) is still unclear. Many researchers believed that the causes of OA could be articular cartilage changes such as structure, biochemistry and metabolism, which might be influenced by one or a combination of genetic factors, overuse, accidents, aging, dietary and inflammatory factors (Burnett et al., 2006; Bennett, 2010). The prevalence of canine osteoarthritis increased from 15% to 67% as dogs aged (Gail et al., 2006). Moreover, another study showed that canine OA affected about 20% of dogs that were more than one year old (Johnston, 1997).

According to the pathogenesis and clinical outcomes of OA, there are two purposes of OA management, which are to relieve pain and to prevent OA progression. Surgical, medical and/or nutraceuticals are provided to achieve these aims (Wang et al., 2004). The development of nutraceuticals has led to the hope that inhibition of the inflammatory pathway can cause a reduction in articular degradation. For this reason, the anti-inflammatory properties of omega-3 polyunsaturated fatty acids (omega-3 PUFAs) have attracted great interest as a possible OA treatment. There are many types of omega-3 PUFAs, of which eicosapentaenoic acid (EPA), docasahexaenoic acid (DHA) and eicosatetraenoic acid (ETA) are the three best-known types (Yuan et al., 2006; Treschow et al., 2007; Roush et al., 2010). Many clinical researchers revealed that both green-lipped mussel extract (GLM) and fish oil (EPA 18% and DHA 12%) could reduce pain and increase joint mobility in OA cases because they had an anti-inflammatory effect. Many researchers demonstrated that omega-3 PUFAs (especially ETA and EPA) might affect the LOX and COX pathways by reducing the production of leukotrienes and prostaglandins (Whitehouse et al., 1997; Dugas, 2000; Murphy et al., 2002). Identification of GLM components found a predominant PUFA (ETA) structure that was similar to arachidonic acid. As a result of a reduction in LOX production, the PUFAs in GLM might be a significant anti-inflammatory compound (Treschow et al., 2007).

Recently, Roush et al. (2010), Hielm-Bjorkman et al. (2012) and Zawadzki et al. (2013) have evaluated the effects of fish oil on weight bearing in OA dogs. Moreover, other researchers showed that greater EPA and DHA concentrations could improve the clinical signs (lameness and weight bearing) of OA dogs (Fritsch et al., 2010a; Fritsch et al., 2010b). Another study on the use of GLM in OA dogs found that the clinical signs improved significantly after six weeks (Bierer and Bui, 2002).

PCSO-524 has a huge difference in efficacy between other mussel extracts and powders due to the patented CO_2 extracted oil (Whitehouse et al., 1997). Recently, there has been growing interest in osteoarthritis biomarkers as primary outcome measures. Although considerable research has been devoted to clinical signs of improvement, rather less attention has been paid to OA biomarkers as a mean by which to monitor disease activity and predict disease progression. Thus, the aim of this study was to examine the positive effect of PCSO-524 (a long-chain omega-3 PUFA compound from the New Zealand green-lipped mussel) on the osteoarthritis biomarker level, weight-bearing properties in the treatment of canine shoulder and coxofemoral osteoarthritis compared to fish oil.

Materials and Methods

Sixty-six dogs showed signs of coxofemoral and/or shoulder osteoarthritis, which included limb lameness, joint pain, stiffness and decreased range of motion (ROM) (Millis, Taylor, & Levine, 2004). Moreover, the evidence of OA at coxofemoral or shoulder joints was indicated in radiographs (Sirois et al., 2010). The dogs were only fed commercial standard food (Royal Canin® mature large breed) for at least two weeks before the study. The exclusion criteria during this study were: 1. severe liver, gastrointestinal, urogenital, or neurological problems and/or pregnant; 2. previous OA treatment with other drugs or dietary supplements; and 3. a pain-score evaluation of more than five points on the scale of the Glasgow Composite Measure Pain Score-Short Form (Gaynor and Muir, 2009). Animal owner informed consents were gained and the trial procedures were approved by the Faculty of Veterinary Science, Chulalongkorn University's Ethics Committee, Bangkok, Thailand (No. 12310001).

The 66 OA dogs were divided into two groups by blind randomized sampling (Table 1). The PCSO-524 group (produced by MacLab in Nelson, New Zealand (Gibson, 2000) (n = 33) were fed PCSO-524 with the recommended dosage (50mg/10kg body weight) once daily. The fish oil group (n = 33) received fish oil with the recommended dosage (1,000 mg/dog twice daily) produced by Mega Lifesciences (Thailand) (Table 2). The animals were reassessed at weeks two (W2), four (W4), eight (W8), 12 (W12), 16 (W16), 20 (W20) and 24 (W24) for clinical evaluations and blood collection. The owners' preferences were assessed monthly. The treatment was terminated at the end of the sixth month.

The severity of clinical lameness and OA scoring were evaluated and recorded before (D0) and after treatment, as well as at weeks two, four, eight, 12, 16, 20 and 24 by the use of the clinical scoring system (Table 3) and the measurement of range of motion (ROM - using a goniometer) by the same veterinarian (Millis et al., 2004; McCarthy et al., 2007). The OA scoring was defined by using radiographic and clinical lameness correlation. Double measurement of ROM was required in each position of assessment and mean was calculated and recorded. The veterinarian was blinded to group classification when he scored. Peak vertical force gait analysis was performed in each leg while the dogs were standing and walking for 3 times by using the platform system (Chalayon et al., 2013). Data were averaged, analyzed and scoring collaborated with weight-bearing properties compared with the expected normal weight-bearing properties in each leg (Table 3). The normal ratio between forelimbs and hind limbs is 60:40. The average weight-bearing peak vertical force was calculated by comparison with the expected weight bearing of each limb. The lameness scores were defined as improved, not improved and worsened if there were different

lameness scores before and after treatment. The peak vertical forces of the improved group should be better than 5% of normal expected values.

Four milliliter blood samples were collected from each dog at pre-treatment and at weeks two, four, eight, 12, 16, 20 and 24 post-treatments. One milliliter was separated into two parts for complete blood counts (CBCs) and blood chemistry tests (alanine aminotransferase, aspartate aminotransferase, blood urea nitrogen and creatinine). The CBCs samples were kept in anticoagulant (100IU/ml heparin; APS Finchem, Australia). The analysis was performed only three times, before weeks 12, 24 and after treatment, to evaluate the health of animals. To prepare OA biomarker samples, three milliliters of blood was centrifuged at 7,000 x g for 15 minutes to obtain about one milliliter of serum. This serum was frozen at -20°C until a biomarker assay was performed. The competitive inhibition quantitative enzyme-linked immunosorbent assay (ELISA) method was applied. The ELISA detected the monoclonal antibody WF6, which was the primary antibody (Tangkijvanich et al., 2003). Then, the samples were added to microplate wells that were prepared with embryonic shark skeletal cartilage aggrecan to be a coating antigen, or to be a competitor. Next, peroxidase conjugated anti-mouse immunoglobulin M (IgM) antibody was added as a secondary antibody and the sample was incubated. To encourage concentration of the epitope WF6, the substrate was added and absorbance was determined. Finally, the concentration of the epitope WF6 was calculated and recorded.

Table 1 Signalment of animals

Group	Number (N)	Joint (n)	Age (year) (mean [SD])	Body weight (kg) (mean [SD])	Sex (N)
PCSO-524	33	Hip (42) Shoulder (7)	7.65 (1.84)	27.48 (4.98)	Female (14) Male (19)
Fish oil	33	Hip (40) Shoulder (4)	6.65 (1.79)	24.37 (5.57)	Female (18) Male (15)

Table 2 Composition of PCSO-524* and fish oil**

Group of treatment	Composition of a capsule	Dose
PCSO-524 (50 mg/capsule)	- *Perna canaliculus*oil 50 mg - Vitamin E 0.225 mg - Others: olive oil, gelatin and glycerine	1 capsule per 10 kg once daily (8 weeks)
Fish oil (1000 mg/capsule)	Fish oil 1,000 mg - EPA 180 mg - DHA 120 mg - Vitamin E 1.4 mg	1 capsule per dog once daily (8 weeks)

*MacLab in Nelson, New Zealand ** Mega Lifesciences (Thailand)

Table 3 Weight bearing properties measured by peak vertical force gait analysis. Data were analyzed as percentage of expected weight bearing in each leg: 60:40, forelimbs: hind limbs.

Joint	Patients with OA in hip joints (percentage of mean [SD])					Patients with OA in shoulder joints (percentage of mean [SD])				
Time	**D0**	**W2**	**W8**	**W16**	**W24**	**D0**	**W2**	**W8**	**W16**	**W24**
PCSO-524	64.5 (6.43)	79.3 (4.32)	82.1 (8.42)	88.7 (5.11)	89.2 (5.81)	68.1 (4.18)	81.4 (7.12)	86.7 (3.84)	89.3 (6.18)	91.2 (2.12)
Fish oil	66.8 (8.41)	68.4 (5.31)	70.1 (9.21)	71.5 (8.76)	72.3 (3.14)	67.8 (9.42)	68.9 (7.63)	70.4 (8.43)	71.2 (9.44)	71.6 (4.56)

For observation of the supplements' side effects, we used a routine coagulation test as screening. Buccal mucosal bleeding time was measured before the treatment commenced and at weeks 12 and 24 after PCSO-524 and fish oil administration. If the dogs had prolonged bleeding time (more than 2.6 minutes), coagulogram (activated partial thromboplastin time, prothrombin time and thrombin time) was performed (Jergans et al., 1987).

The concentration of OA biomarkers (WF6) from the serum and ROM were reported as mean ± SD each week in the same treatment. The paired t-test procedure was used to test for differences between before and after treatment in the same group. Comparison between groups was analyzed using an unpaired t-test. The clinical sign scores was calculated as mean ± SD using the non-parametric two samples Mann Whitney procedure (Powers and Knapp, 2010). Relative data were analyzed using the SPSS program (SPSS). *p*-values less than 0.05 were considered to be significant.

Results

CBCs and serum chemistry were evaluated in all dogs at D0 and W24. Most of the values were not significantly different between D0 and W24 ($p>0.05$) (Table 4). All means of parameters were in normal range at both D0 and W24 in the two groups. There was no significant difference in CBCs and blood chemistry

between the PCSO-524 group and the fish oil group at both D0 and W24 (Table 4). The buccal mucosal bleeding times were normal and there were no significant differences before and after treatment in either group.

The serum of 66 dogs was evaluated by the CS-WF6 epitope concentration (Fig 1). The levels of serum CS-WF6 epitope at D0 were not significantly different between the groups. In the PCSO-524 group (n = 33) the level of serum CS-WF6 epitope was significantly lower at W2, W4, W8, W12, W16, W20 and W24 compared with the level at D0. In the fish oil group (n = 33) the level of serum CS-WF6 epitope at W8 and W20 was significantly greater than that before the treatment commenced (D0). There was a significant difference in CS-WF6 concentration between the groups at the 24th week after the treatment commenced.

The evaluations of the weight-bearing score in 82 hip joints were performed eight times within 24 weeks (Fig 2). Results revealed that the mean scores for weight bearing in the PCSO-524 group showed significant improvement (p<0.05) at W2 to W24, respectively, while in the fish oil group they were not significantly different during the first 12 weeks of treatment. The means of weight-bearing scores were significantly different between the groups after four weeks of administration (p<0.05). Eleven shoulder joints were evaluated for weight-bearing scores (Fig 3). Results revealed that the mean scores for weight bearing in the PCSO-524 group showed significant improvement (p<0.05) after the first two weeks of administration compared with D0, while in the fish oil group they were not significantly different within the treatment period. The means of weight-bearing scores were significantly different between the groups at W4, W8, W12, W16, W20 and W24 (p<0.05). The OA dogs were evaluated for clinical outcomes (lameness and weight bearing) by joints that were affected separately. Eighty-two hip joints and 11 shoulder joints that were assessed by clinical scoring was categorized into three groups: improved, not improved and worsened after 24 weeks of the administration of PCSO-524 (Table 5).

Table 4 Comparison of CBCs and blood chemistry profiles between pre-treatment (D0) and post-treatment (W24) within group.

Parameters	Normal range (Bennett, 2010)	D0		W24		p-value†	
		PCSO-524	Fish oil	PCSO-524	Fish oil	PCSO-524	Fish oil
R.B.C.x10^3 (cell/µl)	5.2-8.06	6.15±1.32	6.62±0.78	6.38±1.19	6.93±0.73	0.2712	0.0901
Hemoglobin (g/dl)	12.4-19.1	14.41±2.47	15.35±1.68	14.76±2.26	15.58±1.3	0.3087	0.3029
Hematocrit (%)	29.8-57.5	41.66±6.21	44.22±4.80	42.25±6.30	45.31±5.26	0.3769	0.2333
Platelet x10^3 (cell/µl)	160-525	289.47±81.29	297.47±61.64	293.52±67.65	286.34±46.34	0.4276	0.2462
W.B.C. x10^3 (cell/µl)	5.4-15.3	10.00±3.76	11.10±2.86	10.04±2.49	10.27±1.69	0.4842	0.1206
Neutrophils (%)	51-84	71.60±9.92	72.95±6.88	70.91±7.75	71.08±8.17	0.3961	0.2030
Eosinophils (%)	0-9	2.26±2.92	2.91±2.69	2.08±2.37	2.04±1.74	0.4129	0.1003
Basophils (%)	0-1	0.21±0.51	0.04±0.20	0.21±0.67	0.17±0.38	0.5000	0.0811
Lymphocytes (%)	8-38	17.34±7.46	16.13±5.96	15.82±5.41	14.60±6.23	0.2165	0.2011
Monocytes (%)	1-9	6±2.29	6.00±1.88	5.21±2.77	5.52±2.15	0.1517	0.2133
ALT (U/l)	4-91	34.43±10.16	58.89±27.79	35.69±9.63	34.13±12.67	0.3345	0.1256
ALP	3-60	57.21±31.44	62.86±31.39	56.52±20.5	56.56±20.83	0.4466	0.1280
BUN (mg%)	7-26	16.17±7.85	14.65±3.92	15.29±5.65	16.69±4.64	0.3120	0.4026
Creatinine (mg%)	0.6-1.4	1.1±0.38	0.94±0.22	1.07±0.47	0.90±0.20	0.4196	0.2983

$^{\dagger}p$-values between pre-treatment (D0) and the end of treatment (W24) in the PCSO-524 and fish oil groups. R.B.C: red blood cell, W.B.C: white blood cell, ALT: alanine aminotransferase, ALP: alkaline phosphatase, BUN: blood urea nitrogen. Data are expressed as mean±SD.

Table 5 Clinical outcomes after 24 weeks of PCSO-524 administration (hip and shoulder joints; n = 49)

Clinical outcomes (%)	Improved	Not improved	Worsened
Lameness score	43 (87.76%)	4 (8.16%)	2 (4.08%)
Weight-bearing score	39 (79.59%)	8 (16.33%)	2 (4.08%)

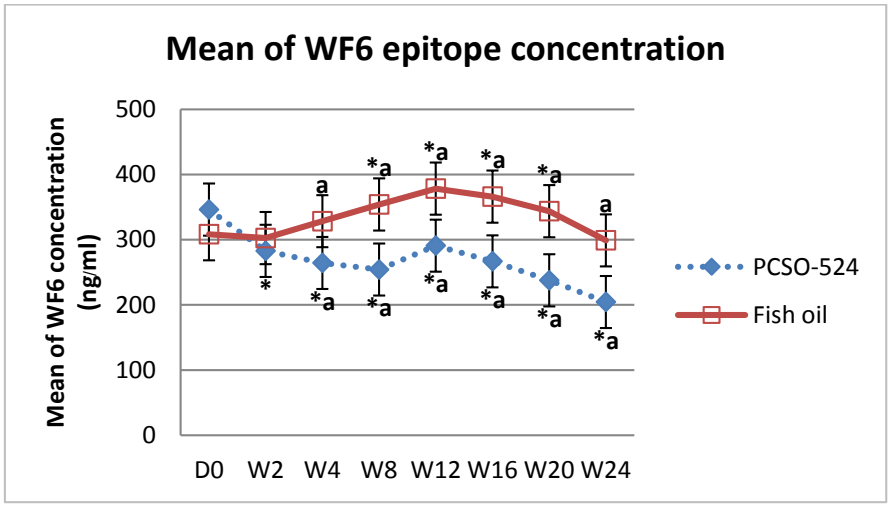

Figure 1 Mean of the levels of serum chondroitin sulfate epitope (CS-WF6; ng/ml). *Values were significantly different compared with D0 within the groups (p<0.05). [a]Values were significantly different between the groups within the week (p<0.05).

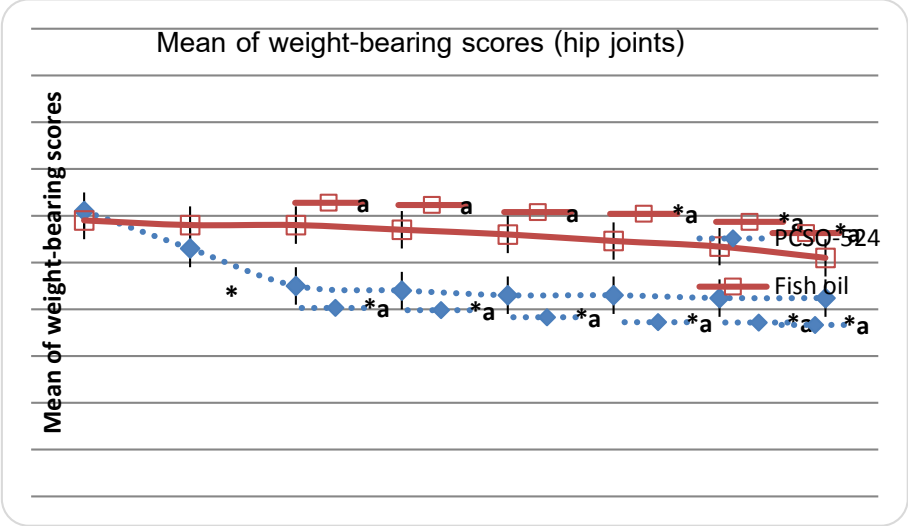

Figure 2 Mean of weight-bearing scores (hip joints). *Values were significantly different compared with D0 within the groups (p<0.05). [a]Values were significantly different between the groups within the week (p<0.05).

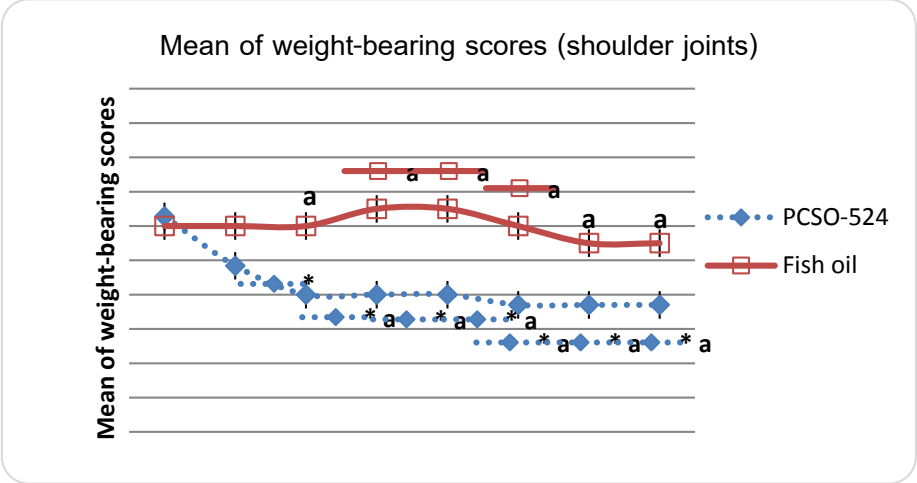

Figure 3 Mean of weight-bearing scores (shoulder joints). *Values were significantly different compared with D0 within the groups (p<0.05). [a]Values were significantly different between the groups within the week (p<0.05).

The peak vertical force was calculated into percentage compared to the normal weight- bearing properties (forelimb = 30% and hind limb = 20%). The peak vertical force (PVF) while standing and walking in the PCSO-524 group significantly improved than in the fish oil group since the 2nd week of administration in the forelimbs and hind limbs (Table 5 and 6). ROMs were acquired from 46 dogs, which were divided into two groups (Table 7). In the PCSO-524 group there were 42 hip joints and seven shoulder joints. In the fish oil group there were 40 hip joints and four shoulder joints.

Table 6 Clinical outcomes after 24 weeks of fish oil administration (hip and shoulder joints; n = 44)

Clinical outcomes (%)	Improved	Not improved	Worsened
Lameness score	14 (31.81%)	24 (54.55%)	6 (13.64%)
Weight-bearing score	13 (29.55%)	22 (50.00%)	9 (20.45%)

Table 7 Mean (SD) of ROMs in the PCSO-524 group and the fish-oil group

Joint		Hip joints (mean [SD])					Shoulder joints (mean [SD])				
Time		D0	W2	W8	W16	W24	D0	W2	W8	W16	W24
Flex (degree)	**PCSO-524**	40.11 (7.50)	34.57* † (6.87)	33.32* † (4.79)	33.44*† (4.76)	32.03*† (4.64)	51.93 (9.32)	41.93*† (8.99)	38.43*† (6.98)	38.73*† (7.86)	36.75*† (5.80)
	Fish oil	39.25 (6.63)	38.51 † (7.01)	39.55 † (6.03)	34.15* † (5.65)	32.45* † (5.55)	53.16 (3.01)	51.33 † (1.89)	51.50 † (2.78)	49.41*† (0.87)	46.33* † (1.37)
Extend (degree)	**PCSO-524**	122.60† (10.74)	130.6* (11.74)	135.91* (10.02)	137.48* (8.48)	137.90* (7.96)	121.75† (4.66)	127.87*† (5.8)	132.31* (10.74)	134.31* (8.17)	136.58* (5.80)
	Fish oil	130.60† (11.41)	132.21 (7.98)	134.89 (6.33)	136.53* (5.65)	138.74* (5.35)	136.66† (5.77)	136.33† (5.34)	137.16 (4.90)	139.5* (6.94)	139.00* (4.82)

*Values were significantly different compared with the pre-treatment (D0) values within the groups ($p<0.05$).
†Values were significantly different between the groups within the week ($p<0.05$).

Discussion

The results of this study revealed that the lameness score, peak vertical force weight-bearing score and ROM in the PCSO-524 group showed significantly greater improvement than those in the fish oil group. The level of the WF6 epitope was significantly less than that of the fish oil group. These results supported the improvement of OA signs and the slow OA progression among the dogs that were given PCSO-524. This was in accord with previous studies which found that OA dogs had greater lameness scores and a greater concentration of WF6 epitope than those found in normal dogs (Nganvongpanit et al., 2008a; Trakulsantirat et al., 2011). The subjective assessment of OA signs is inferior to an objective assessment obtained from force-platform gait analysis (Roush et al., 2010). The clinical outcomes in the present study, however, were assessed by the same blinded veterinary orthopedist who has extensive experience in the treatment of OA. This study found that the clinical lameness and the peak vertical force weight-bearing properties correlated and improved in the PCSO-524 group, whereas those in the fish oil group worsened at four weeks after the administration commenced. The percentage of clinical outcomes after 24 weeks of PCSO-524 administration revealed a progression of lameness and weight-bearing scores of only 4.08%. One dog required surgical intervention at the femoral head and neck excision. Rehabilitation, NSAIDs and omega-3 were applied for pain relief and to assist in the return of limb function. The veterinarian decided to give more treatment because the pain score evaluation was more than five points on the scale of the Glasgow Composite Measure Pain Score-Short Form (Gaynor and Muir, 2009).

Previous studies investigated the serum WF6 epitope level and the alteration of the articular cartilage, which was more sensitive to joint cartilage degradation (Nganvongpanit et al., 2008a; Pruksakorn et al., 2009). Therefore, the released serum WF6 from extracellular matrix of joint cartilage is due to the destruction of cartilage and the assay should be proven for monitoring OA treatment or before and after traumatic arthritis detection (Pruksakorn et al., 2009). The results showed that the serum WF6 epitope concentration in the PCSO-524 group was significantly less than the concentration in the fish oil group at the end of study. It is interesting that PCSO-524 may decrease the cartilage destruction in OA dogs and the effect was detected after two weeks of administration. At W12 the PCSO-524 group showed that a mildly increased WF6 level could result from an induced catabolic process of the articular cartilage, but joint metabolism recovered to maintain the balance of the joint metabolism (Nganvongpanit et al., 2008b). On the other hand, the dogs to which fish oil were administered continued to experience joint cartilage degradation, as indicated by an increase in the WF6 epitope concentration. The trend of the WF6 level of the fish oil group was decreased slightly after W12. A further long-term study should be performed. A systematic review of research on the efficacy of nutraceuticals for the relief of the clinical signs of osteoarthritis examined 22 papers. Although the conclusion was that the efficacy of nutraceuticals was poor, omega-3 fatty acid in dogs was the exception (Van de Weerd et al., 2012). The efficacy of omega-3 use

in OA dogs varies according to the source, the omega-3 to omega-6 ratio, the volume of EPA and DHA and also the extraction method and subsequent processing. The carrier elements and the anti-oxidant used to stabilize an active ingredient also have an effect on the efficacy (Whitehouse et al., 1997; Treschow et al., 2007; Fritsch et al., 2010a; Fritsch et al., 2010b). A study revealed that high EPA and DHA concentrations in food (approximately 2.94% of dry weight) and a high omega-3 to omega-6 fatty acid ratio (approximately 2.19) improved the clinical outcome significantly after 90 days (Fritsch et al., 2010a). Another study found that the lameness and weight-bearing scores of 38 OA dogs improved after they received a diet that contained 3.5% omega-3 fatty acids (fish oil) (Roush et al., 2010). These results were the opposite of what this study found, however the period of the study of Roush (2010) was only 60 days. The result of a consistent dose of fish oil in dogs is not understood well because there have been only a small number of animal studies. The adverse effect is that EPA may inhibit blood clotting. There are no known adverse effects of DHA (Beale, 2004). The impact on blood clotting was measured twice (monthly) during the term of a study, by recording the buccal mucosal bleeding. All the dogs experienced normal bleeding (less than 2.6 minutes) (Jergans et al., 1987). It should also be borne in mind that the omega-3 and omega-6 content of each product is different because of source variation and different processes. The source of an omega-3 has been shown to have a great bearing on its efficacy. Omega-3 chains extracted from the New Zealand green-lipped mussel (*Perna canaliculus*) have been shown to be much more potent than fish oil as an anti-inflammatory (Whitehouse et al., 1997). Omega-3 fatty acids in fish oil include EPA and DHA (Fritsch et al., 2010a), but those in PCSO-524 include compound fatty acids (ETA, EPA, DHA, etc.) (Treschow et al., 2007). Although PCSO-524 is a GLM extract, it is different from other GLM products. PCSO-524 is the result of a patented extraction and stabilization process part of which a super-critical fluid process is used (Whitehouse et al., 1997; Treschow et al., 2007; Soontornvipart and Mongkhon, 2012). PCSO-524 is a lipid-rich extract that improved OA signs and delayed cartilage degradation at the second week after administration in the present study. A new study of 12 weeks of PCSO-524 administration to dogs that had OA at shoulder, hip and/or stifle joints and cauda equine syndrome revealed that a large percentage of dogs improved in clinical lameness (Mongkon and Soontornvipart, 2012). These studies provide evidence of the efficacy of GLM. The present study found that the unique composition of PCSO-524 provided a faster rate of improvement than the GLM powder. A study that compares the efficacy of different GLM extracts will provide useful data. Another advantage of PCSO-524 is that it can be used in the long term without adverse side effects (Beale, 2004; Wang et al., 2004) to treat OA, provide pain relief and help dog to regain limb function quickly (Bennett, 2010; Nelson et al., 2006). This study indicated that PCSO-524 had a greater therapeutic effect on OA dogs than fish oil. The administration of PCSO-524 can improve clinical signs and ROM, and decrease the level of serum WF6 epitope in canine shoulder and coxofemoral osteoarthritis. There were no proven side effects in either of the nutraceuticals administered during this clinical trial. The analyses of complete blood counts and blood chemistry were not different between pre-treatment and the end of this study.

In conclusion, the PCSO-524 administration led to good clinical outcomes and laboratory results of osteoarthritis of the shoulder and hip joints in dogs. The fish oil did not show any positive effects in the canine osteoarthritic treatment.

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บทคัดย่อ

ผลของ PCSO-524 ต่อสารบ่งชี้ทางชีวภาพในภาวะข้อเสื่อมและความสามารถในการลงน้ำหนักขาในสุนัขที่มีภาวะข้อไหล่และข้อสะโพกเสื่อม

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การศึกษาเปรียบเทียบผลการลงน้ำหนักของขาและสารบ่งชี้ทางชีวภาพในภาวะข้อเสื่อมระหว่างสารประกอบกรดไขมันโอเมก้า 3 ในหอยแมลงภู่นิวซีแลนด์ (PCSO-524) กับกรดไขมันโอเมก้า 3 ในน้ำมันปลา ในสุนัขที่มีภาวะข้อเสื่อม 66 ตัวที่เข้ามารับการรักษาในโรงพยาบาลสัตว์เล็ก จุฬาลงกรณ์มหาวิทยาลัย จัดเป็นสุนัขที่มีภาวะข้อสะโพกเสื่อม 39 ตัว สุนัขที่มีภาวะข้อหัวไหล่เสื่อม 15 ตัว และสุนัขที่มีภาวะทั้งข้อสะโพกร่วมกับหัวไหล่เสื่อม 12 ตัว แบ่งสุนัขทั้งหมดออกเป็น 2 กลุ่ม กลุ่มแรกได้รับ PCSO-524 (n = 33) และกลุ่มที่สองได้รับน้ำมันปลา (n = 33) ด้วยวิธีการกินเป็นระยะเวลานาน 24 สัปดาห์ ประเมินผลจากปริมาณสารบ่งชี้ทางชีวภาพในซีรั่ม (WF6) คะแนนการแสดงอาการเจ็บขา คะแนนการลงน้ำหนัก มุมของข้อต่อ และการใช้เครื่องวัดปริมาณการลงน้ำหนัก ทั้งก่อนได้รับเภสัชโภชนาและในสัปดาห์ที่ 2, 4, 8, 12, 16, 20 และ 24 ภายหลังได้รับเภสัชโภชนา พบว่าค่าเฉลี่ยปริมาณสาร WF6 ในซีรั่มของสุนัขกลุ่มที่ได้รับสาร PCSO-524 (262.46±118.06 ng/ml) น้อยกว่าสุนัขกลุ่มที่ได้รับน้ำมันปลา (324.76±133.65 ng/ml) อย่างมีนัยสำคัญทางสถิติ ($p<0.05$) ตั้งแต่สัปดาห์ที่ 24 ของการศึกษา ส่วนคะแนนการแสดงอาการเจ็บขา คะแนนการลงน้ำหนัก มุมของข้อต่อ และปริมาณการลงน้ำหนักดีขึ้นอย่างมีนัยสำคัญในสุนัขกลุ่มที่ได้รับสาร PCSO-524 ภายหลังจากเริ่มการรักษา 2 สัปดาห์ ในขณะที่ค่าพารามิเตอร์ทุกตัวในสุนัขกลุ่มที่ได้รับน้ำมันปลาไม่มีการเปลี่ยนแปลงอย่างมีนัยสำคัญทางสถิติภายหลังจากเริ่มการรักษาไป 12 สัปดาห์ ในสัปดาห์ที่ 4 พบว่าคะแนนการแสดงอาการเจ็บขา คะแนนการลงน้ำหนัก และปริมาณการลงน้ำหนักของสุนัขกลุ่มที่ได้รับสาร PCSO-524 ดีขึ้นอย่างมีนัยสำคัญเมื่อเปรียบเทียบกับสุนัขกลุ่มที่ได้รับน้ำมันปลา โดยสรุปแล้วพบว่าการใช้สาร PCSO-524 นั้นให้ผลทางคลินิกและผลวิเคราะห์ทางห้องปฏิบัติการที่ดีขึ้นในสุนัขที่มีภาวะข้อสะโพกและ/หรือข้อหัวไหล่เสื่อม

คำสำคัญ: สุนัข น้ำมันปลา หอยแมลงภู่นิวซีแลนด์ ข้อเสื่อม พีซีเอสโอ 524 ดับเบิลยูเอฟ 6

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